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ABSTRACT

This paper reports on a study at the Children's Museum of Indianapolis that examined how two-way audio/visual interactive learning (2WAVIL) technology can be used to help prepare students prior to a museum visit, hoping that this preparation may help students interact with exhibits in a more constructivist manner. The study focused on children's interpretations of their experience in a novel science museum setting and the 2WAVIL link that preceded it, the classroom teacher's interpretation of those children's experiences, and a comparison of the two. Data were collected from a fifth grade classroom approximately 150 miles from the city; four students and one teacher served as key informants. Data were gathered through interviews, observations, field notes, and researcher reflections. Common themes generated from the interviews were developed and synthesized into assertions about the nature of the experience; these assertions were triangulated with the other data to strengthen the nature of the study. Results suggest that the technology was effective in orienting the students to the gallery environment, supporting research that iterates that any type of advanced organizer will have some positive cognitive and/or affective outcomes. (Contains 14 references.) (DLS)

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From Volcanoes to Virtual Tours: Bringing Museums to Students Through Videoconferencing Technology

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Constructivism in a Museum Environment

Development of a Constructivist-Based Science Gallery

Museums are taking on a more active role in the education of children. Science museums and other informal science centers such as zoos, aquaria, and environmental centers have increased in popularity because they provide opportunities that extend beyond the traditional museum. Bitgood, Serrell, and Thompson (1994) highlight a major advantage that informal learning environments have over the traditional classroom. These sites are often able to meld affective and cognitive learning experiences. In other words, children learn concepts through play. Another advantage is that children are able to control their "time-on-task," even though that time may be shorter, and more episodic than in a traditional classroom. Thus, children are more apt to pursue those exhibits which possess science content that is relevant and meaningful to them. In essence, museums provide a medium for learning that parallels the educational epistemology of constructivism. Constructivist beliefs assert that children's learning occurs when their existing understanding of a concept is challenged by an experience or phenomenon that cannot be supported by that understanding. The learner is forced to develop a new conception that is more useful, rational, and intelligible (Posner Strike, Hewson, & Gertzog, 1982). The role of education is to provide such challenges for the students.

Schauble and Bartlett (1997) explain that this constructivist notion provided the framework for the design, construction, and educational programming of the recently completed ScienceWorks Gallery within The Children's Museum of Indianapolis. Exhibits were created that could "build upon and extend activities first encountered at the museum into other contexts, such as the child's home, school or backyard" (p. 784). In addition to the physical design, the museum recognized that to truly develop a constructivist approach, children's involvement with the exhibits should occur with mediation and guided interpretations. In other words, children need to be talking with others about what they are experiencing. Gallery educators are encourage to answer inquiries, but more importantly, they are encouraged to ask visitors open ended and thought provoking question. Gallery interpreters are trained to be sensitive to the manner in which children think and learn while visiting exhibits. Less emphasis is placed on dissemination of factual content, with a greater significance being directed toward demonstrating those educational strategies that help guide children toward science understanding. In short, the museum is striving to apply classroom constructivist methodology to an informal science environment.

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Incorporating a Constructivist Approach for Distance Learning

While the museum has experienced a great deal of success executing these beliefs for their on-site visitors, recent innovation in the use of two-way audio-visual videoconferencing as a means of sharing museum resources adds another, more complex layer.

Currently, the museum is struggling with the question: "How can an informal environment, built upon a foundation of free-choice exploration with mediated interpretations, promote meaningful and relevant experiences for school children via videoconferencing technology?"

The notion of "independent" would not seem feasible in a situation that requires students to remain mostly stationary and fixated to a central object of information presentation, the TV monitor. However, Jones and Knezek (1995) state that one of the true benefits of two-way audio/visual interactive learning (from here on referred to as "2WAVIL") technology is the "interactive" nature of the system. It provides a level of intimacy in communication that is not apparent in other forms of distance learning. Colbert, Voglimacci, and Finkelstein (1995) highlight that another strength of the technology lies in its synchronous nature; the teacher and learners experience parallel delivery and reception of information without a time delay. Finally, Jonassen, Davidson, Collins, Campbell, and Haag (1995) suggest that a constructivist epistemology can indeed be implemented through 2WAVIL technology. They state:

> Two-way real time video transmission of information implies a new definition of real-world context. Although video-mediated, constructivist learning environments could potentially include the actual environment or a close facsimile with which the learner could remotely interact. The collaborative problem-solving situations enhance knowledge construction through the addition of visual information and remote interaction with other learners. The video transmission of authentic, realistic contexts adds a significant dimension to anchored instruction and situated learning environments. (p. 18)

Creating Distance Learning Programs at The Children's Museum

In the summer of 1995, The Children's Museum was awarded a Two-way Interactive Video Distance Learning K–12 Curriculum Development Grant from The Corporation for Educational Communications (CEC). The CEC, a not-for-profit organization, administrates funding for Ameritech's Advanced Video Network entitled "The Vision Athena Project." This project helps schools take advantage of the new and evolving telecommunications infrastructure. The focus of Vision Athena is the creation of a learning community of K–12 schools, higher education, and cultural and corporate partners through a statewide fiberoptic network.

The grant covered costs for equipment and content development over a three year period. Equipment was placed in a dedicated distance learning classroom located in the museum's ScienceWork's gallery Additionally, the museum also possess a mobile camera and monitor unit. This unit can be plugged into fifty-four different receptacles located throughout the five-story gallery spaces and collections department house in the basement. These receptacles are wired to an in-house cable network located on the third floor. This central network serves as the head-end from which all broadcasts are received and transmitted via fiberoptic phone lines. This has provided the museum the capability to broadcast and receive transmissions from almost anywhere within its 250,00 square foot facility. Thus, any

of the museum environments can be brought virtually to schools or classrooms that own the appropriate equipment.

Possessing the capability to provide the museum environment to remote locations does not guarantee that interactive teaching techniques will be executed in a manner consistent with constructivist epistemology. Appropriate mediation would need to occur to avoid a didactic approach or "talking head" mode of presentation. Therefore, the museum is currently in the process of creating and adopting various distance learning programs that can be transmitted to elementary and middle schools. These programs attempt to combine museum resources (such as gallery exhibits, collections and museum personnel) with a theoretical framework that models constructivist classroom teaching. To encourage and promote interactivity, the programs include a component of investigation and manipulation of content-related materials. All presentations utilize exhibits and/or artifacts from the museum's 105,000 plus item collections. Some of the programs even include sending artifacts and other materials to the participating sites prior to the 2WAVIL presentation. Thus, these traveling kits allow students to conduct investigations right along with the museum facilitator.

A Research Project That Examines Distance Learning in Museums

Rationale

The museum has discovered that 2WAVIL technology is a unique medium that requires different pedagogical approaches than those which are incorporated for on-site visitors. A search for foundational research to aid the development of these pedagogical approaches has been unsuccessful. The majority of research on 2WAVIL use has focused on implementation throughout the university realm. Few projects investigate applications at the high school level and virtually none exist for the middle or elementary school (Evjemo, Eidsvik, & Danielsen, 1995). Since the potential audience for the museums 2WAVIL programs will be at the elementary level, the absence of such research represents a serious snag in effective 2WAVIL programming construction.

Secondly, many of the studies have reported on cooperation among schools in which one district hires a teacher to broadcast daily lessons via satellite or cable telephone lines to other cooperating schools. While this is often accomplished in a very didactic manner with little interaction from the students, these courses do enable both teacher and learner to become accustomed to the medium (Bork, 1995). 2WAVIL programming created by The Children's Museum has not been used in the manner of a daily replacement setting for the classroom, but rather as a means for providing supplemental experiences for teachers that enrich and support their classroom curricula. Such experiences are often single connections that teachers have scheduled as an enrichment activity.

The museum has decided to approach this deficiency in foundational research by participating in a study which examines how 2WAVIL technology can be used to help prepare students prior to a museum visit. This preparation may enable students to interact with gallery exhibits in a more constructivist-like manner. There is a significant amount of information on the behaviors children exhibit while attending informal science settings. In particular, the behavioral reactions to setting orientation and novelty influence has been examined extensively. This has led some researchers to be concerned that the novelty, or excitement of a field trip, may interfere with task-directed learning. Children spend more energy orienting themselves with the environment than trying to understand the scientific

concept being presented (Falk, 1983). In fact, some studies suggest that extreme novelty could even lead to less exploration and fear (Falk & Balling, 1982; Falk, Martin, & Balling, 1978; Martin, Falk, & Balling, 1981). Therefore, museums have created orienting materials such as: logistical layouts and agendas given pre-visit, information panels placed anterior to museum exhibits, teacher pre-visit discussions, cognitive preparation materials related to the exhibits, and slide-tape presentations given pre-visit. The purpose of these advanced organizers is to help better prepare students for their museum visit. For example, Kubota and Olstad (1991) introduced a pre-visit novelty reducing treatment via a slide tape presentation of the logistics and highlights of a science center. Their positive outcomes suggest that a two-way audio-visual interactive learning (2WAVIL) videoconference could produce similar results for an elementary audience.

Objectives of the Study

The purpose of this research study is to examine how children and their classroom teacher interpreted a visit to an informal science museum, The ScienceWorks Gallery of The Children's Museum of Indianapolis, following a two-way audio-visual interactive learning (2WAVIL) link. This link, which occurred three days before the museum visit, was broadcasted via the Vision Athena network. This form of "virtual tour" was meant to serve as a novelty reducer for children so that they could better focus on the concepts being presented by museum exhibits. The study examines the influence of a 2WAVIL link on children's "lived" experience at an informal science setting. Specifically, the study addresses the following questions:

- What are children's interpretations of their experience in a novel science museum setting and the 2WAVIL link which preceded it?
- What is the classroom teacher's interpretation of those children's experiences?
- How do the children's and teacher's interpretation of this experience compare?

Design and Procedures

This interpretive study involved a the ScienceWorks Gallery of The Children's Museum of Indianapolis and a fifth grade classroom located 150 miles north of the city. Four elementary children and their teacher in that classroom served as key informants for data collection purposes. Data was gathered through interviews with the key informants, as well as through observations, field notes, and researcher reflections. Data is being interpreted through the development of common themes generated from the interviews and is being synthesized into assertions about the nature of the experience. These assertions are being triangulated with the other three types of data to strengthen the nature of the study. Member checking techniques are being employed with the classroom teacher as a further means to verify interpretations.

Interviews were utilized as the primary data source. An interview was conducted with each key informant following the initial observations but prior to the 2WAVIL link. A second set of interviews occurred immediately following the 2WAVIL link but prior to the museum visit. The third and final set of interviews occurred following the experience at the museum.

Preliminary Results and Findings

Even though the goal of this study is to examine this notion of novelty and the role of an advanced organizer within an informal science setting, one of the limitations was that it also had an inherent second form of novelty, the actual use of the 2WAVIL technology. Since this form of communication is just emerging in the education arena, it is something with which most children and their teachers are not familiar. The use of the communication system could have inadvertently influenced the behavior of the children when they were exposed to a technology in which "they talk to the TV and it talks back." Students may have focused on the novelty of this phenomenon, which could serve as a distraction from the content presented in the distance link experience. This second form of novelty may produce some more interesting findings interwoven within the project design that can be further investigated throughout the data analysis. The interpretation of the data may need to take into account that the students and the teacher may not be responding to the information presented in the link as much as to the workings of the technology.

Preliminary review of student and teacher interviews would suggest that the technology was effective in orienting the students to the gallery environment. Such findings would support the core body of research that iterates any type of advanced organizer will have some positive cognitive and/or affective outcomes. Mrs. Jordan, the fifth grade teacher saw the immediate benefits: "I think it was definitely a positive link to them learning and knowing about what they were going to learn. To actually be in before getting there" (Interview, 11/18/97). Derin, a student key informant, shared a similar reaction to the museum visit which also highlights this notion: "It (the museum) was better than I thought. Cause I was thinking we'd just go through and go to a few different things. But it was really, really neat to be able to be there and do all the stuff we seen on TV" (Interview, 11/18/97).

Derin's comment regarding the type of media used as the advanced organizer provided an interesting finding on the nature of such interactive media. All interviewees felt the opportunity to interact with me added to the excitement of the link and the subsequent trip. When asked to compare the 2WAVIL link with a video-taped tour of the gallery, all emphasized that the ability to ask questions and speak with the tour guide "on the spot" would make a 2WAVIL link more motivating. Interviewer: "Now when we did the distance link, do you think this would have been the same as if I just would have brought in a video tape and showed it to you?" Mitchell (a Key Informant): "No, not really, cause we could actually talk to you, when you were down in Indianapolis, you could talk to us . . . and see us and everything" (Interview 11/18/97).

These same reflections were shared by the Mrs. Jordan who also believed that this was one of her most successful field trips. She feels this is so because many of the students came prepared with a plan of action for their visit. "I think the way you walked through it really put the puzzle together in their mind" and "They knew what they were looking for, they searched things out in all areas" (Interview, 11/18/97).

Preliminary Implications

The results and conclusions of this project will help provide a better understanding of how children think and learn in informal science settings. It will also help extend previous studies done on novelty reducing preparation in informal learning environments. Additionally, this

particular project can serve as one of the few studies that examine the outcomes of using 2WAVIL technology in a classroom and in an informal setting.

The conclusions drawn from the project will have implications for the educational establishment's current push toward the integration of advanced technology in the classroom. It will provide a basis for further studies that implement distance learning technology. It will also provide information for schools and museums that are just beginning to equip their buildings with 2WAVIL technology.

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Autobiographical Sketches

Timothy Barshinger is completing his graduate work at Purdue University in elementary science education. His focus is examining distance learning applications for informal science learning environments. He also serves as the Project Manager of JASON Indiana, the state affiliate of the International JASON project.

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